

GLOBAL MINING GUIDELINES GROUP

**GMG**



Innovation through Collaboration

# MEMBER REPORT

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SEPTEMBER-DECEMBER 2020

## ADAPTING TO A NEW REALITY

Looking back on 2020, while it was full of unprecedented challenges, I also see unprecedented wins that have accelerated innovation in the mining industry. It has been a privilege to watch the industry rise to the occasion as they've turned their operations upside-down and developed entirely new ways of working to adapt to the new reality.

Despite the shift to the virtual world, the velocity of collaboration across the industry has increased thanks to the rapid response from the industry, improving the way we work and connect with one another. The industry has shown itself to be capable of innovation, advancing technologies, while also taking greater than ever care of worker's health and well-being.

Safety continues to be a key priority as we look to the year ahead. Removing workers from hazardous conditions, protecting their health by continuing to enable remote work, and improving support to communities are a focus as the industry continues to innovate operations in the new year.

As an industry-led organization, the focus on safety, technology, and innovation are key drivers of our projects. Recently, we have launched the Implementation of Autonomous Systems version 2 guideline project, a System Safety for Autonomous Mining white paper project, and a white paper project for cybersecurity. As remote work and automation increase as a result of Covid-19, these projects aim to provide essential guidance and information to ameliorate this transition.

Other new initiatives include the launching and developing of working groups, the most recent of which is the Sustainability working group which was voted in strong favour by

members and is currently in the process of defining scope and objectives. The Mineral Processing working group and its Industrial Comminution Efficiency sub-committee are very active: reviewing existing guidelines and putting forth proposals for projects including metal accounting, geometallurgy, process control, and several others to be defined this year.

Additionally, the Interoperability and the Data Access and Usage working groups have merged their efforts to enable clear alignment between projects and clarity for the working group community. Key focuses have been to finalize the interoperability roadmap project and re-visit the open mining format project.

As the range of our initiatives grows, so does our community. It is my pleasure to welcome Stantec, XMPPro, Emesent, ShookIOT, Solvay, Saminco and the McGill COSMO Stochastic Mine Planning Laboratory. The growth not only strengthens collaboration efforts by diversifying the range of perspectives, it extends the reach of valuable guidance to our industry.

I would like to take this opportunity to extend a special thank you to all the volunteers who have dedicated their time to contribute to projects, attend workshops and forums, share their knowledge, and provide their insights over the past months. Your dedication to this industry is reflected by the quality of guidance we are able to provide, an outcome which would be impossible without you. The incredible ability of this industry to come together to co-operatively work towards common goals enables the success of a collaborative organization like GMG.



GRAZIE VINAKA  
TERIMA KASIH  
THANK YOU  
TAKK  
merci

감사합니다  
謝謝  
ありがとう

Hello!

We hope you and your family are doing well.

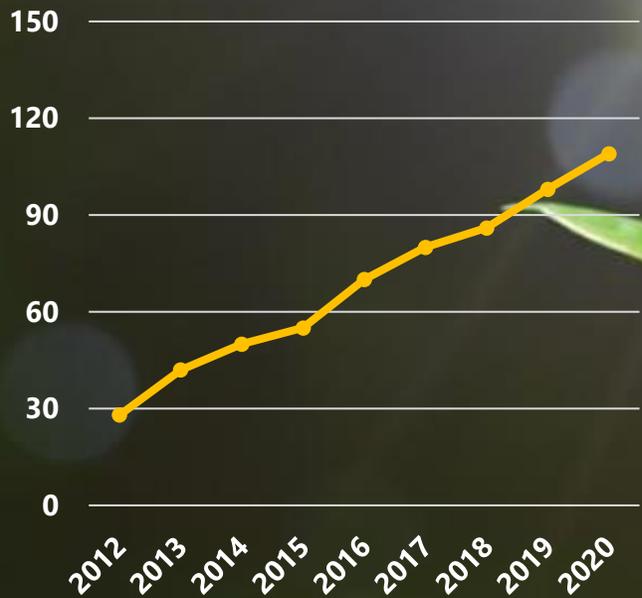
We're taking advantage of this moment to say **THANK YOU** for the time, effort and expertise you've contributed to keeping the collaboration going.

**THANK YOU** for being such a dedicated, tenacious and resilient member of our fantastic industry!

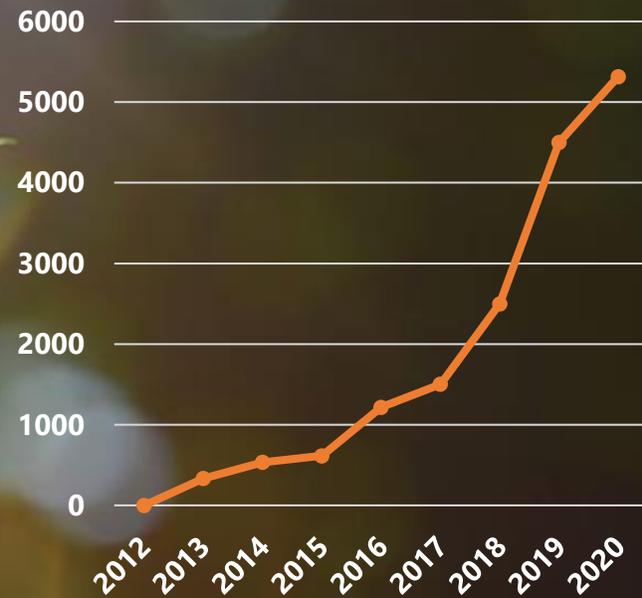
**THANK YOU** for popping up on our screens throughout the past 10 months – the warm greetings, the smiles, and the laughter have made a big impact in our lives and helped us navigate these tough times.

We can't wait to see you again, in person – hopefully at some point this year. Until then, take care and stay safe.

*Your GMG Team*



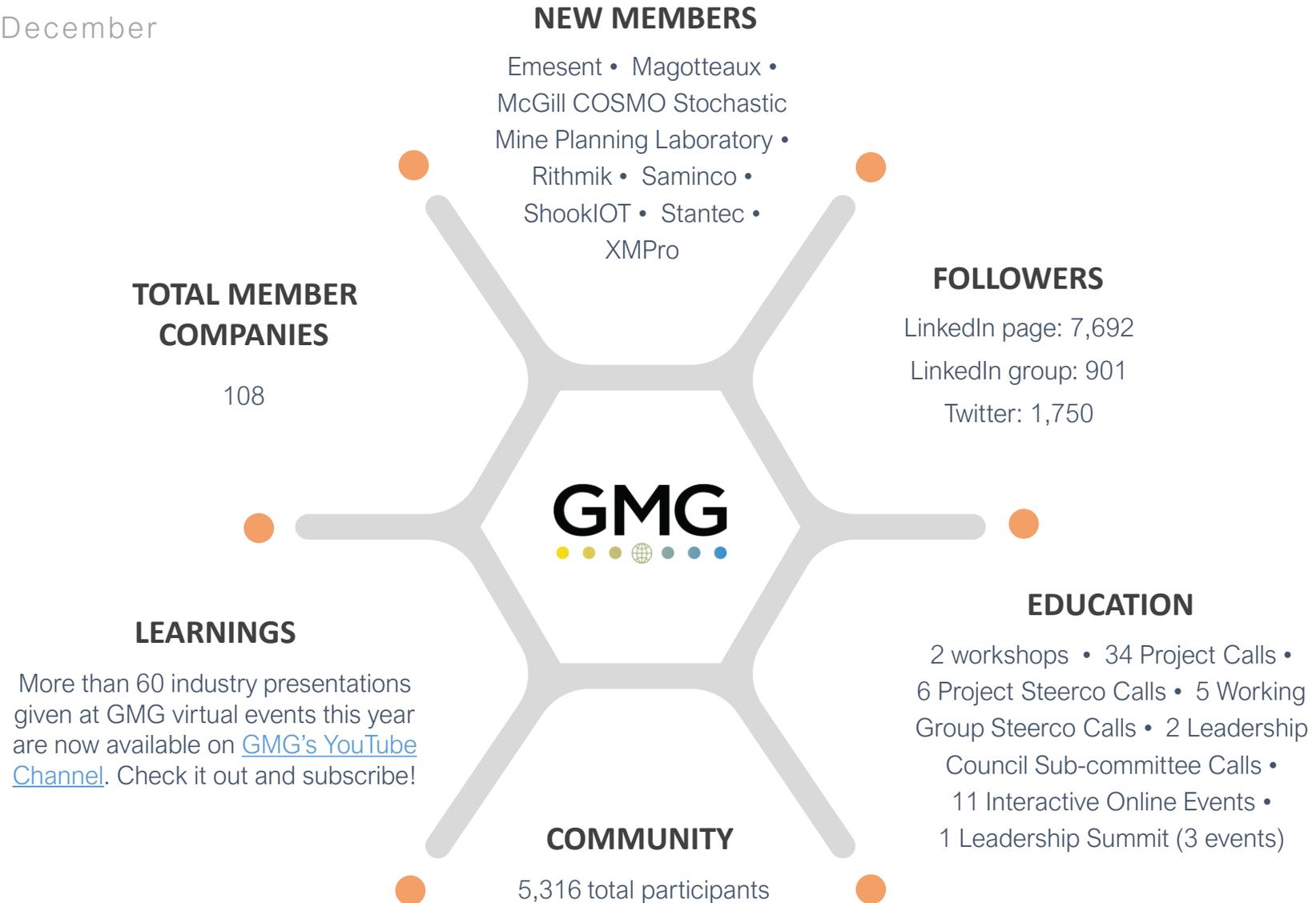
**Member Companies**



**Individual Participation**

# SNAPSHOT

September through December



## Published guidelines

- *Guideline for Applying Functional Safety to Autonomous Systems in Mining*
- *A Standardized Time Classification Framework for Surface Mining*

## Other materials published

- *Mining Response to COVID-19* (summit report)
- *COVID 19 Response and Return to Work Portal* (web resource)
- *Advancing Employee Engagement in Mining: Insights from the Inaugural MECA Symposium* (white paper)

## Guidelines / white papers in final draft

- *Guideline for Sharing Open Data Sets for Artificial Intelligence in Mining*
- *Determining the Bond Efficiency of Industrial Grinding Circuits* (Revision 2)
- *Recommended Best Practices for Battery Electric Vehicles v3*
- *System Safety for Autonomous Equipment*
- *Morrell Method for Determining Comminution Circuit Specific Energy and Assessing Energy Utilization Efficiency of Existing Circuits* (Revision 2)

## Other publications in final draft

- *Mobile Equipment Open Data: Report on Industry Challenges and Next Steps*
- *Interoperability Definition and Principles* (now white paper)
- *3 Autonomous skills migration case studies* (ready to publish once the fourth is finalized and approved)
- *Interoperability Landscape*
- *Workforce of the future and climate action landscapes were also developed*

## Other smaller publications

- *Workshop outcomes* (15 throughout the year)
- *Videos from events and webinars* (64 on our YouTube channel)
- *Electric Mine Operational Knowledge Sharing survey/workshop outcomes*

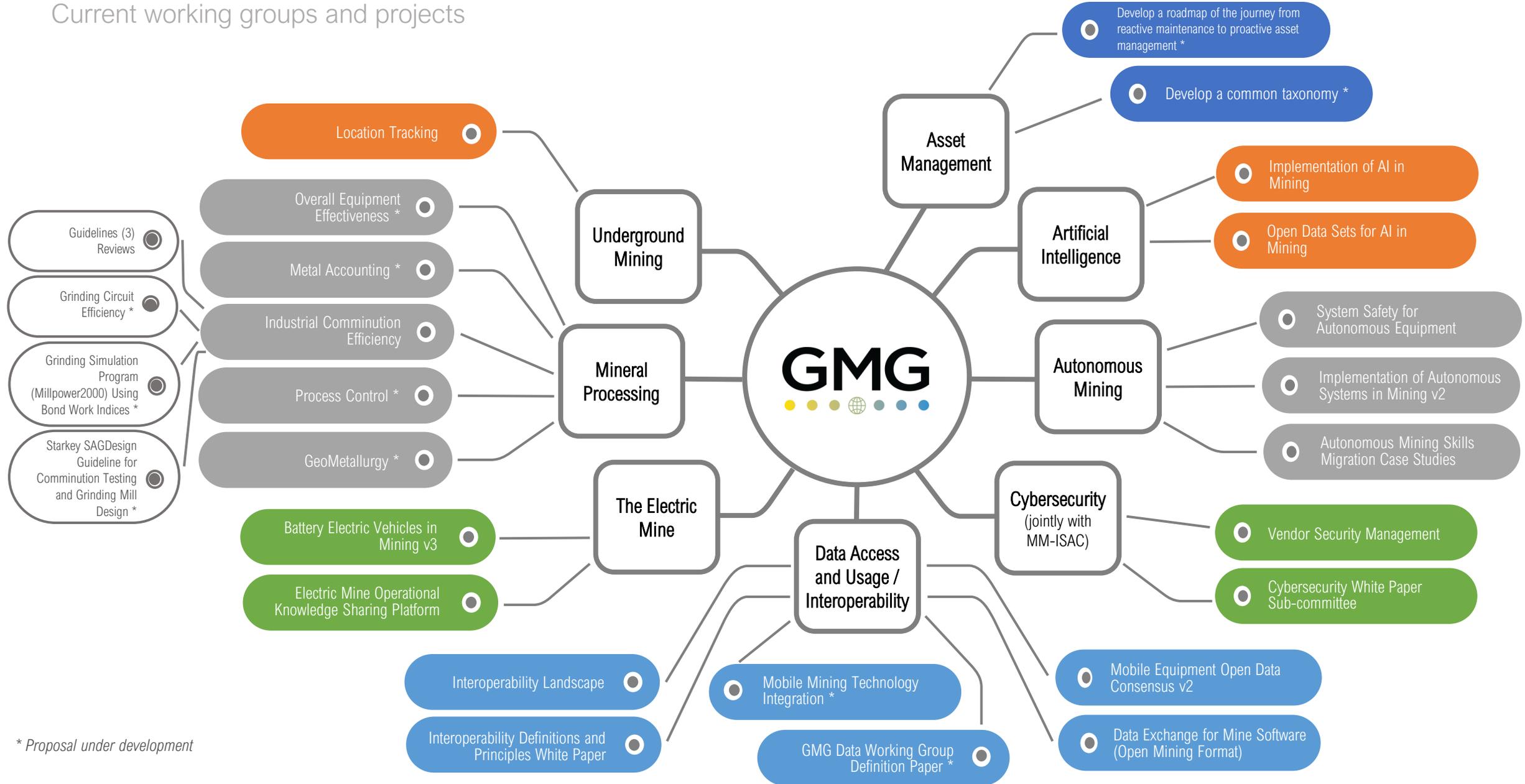
# PROJECT ACTIVITY

SEPTEMBER-DECEMBER



# TEAMWORK MAKES THE DREAM WORK

Current working groups and projects



\* Proposal under development

GROUPS	PROJECTS	LATEST INFO
Artificial Intelligence	<p><b>Implementation of AI in Mining Guideline</b> Leverage lessons learned and case study examples from experience applying AI in mining to develop an implementation guideline and develop a roadmap for the industry so that AI applications can be scalable.</p>	<p><b>Recent Developments:</b></p> <ul style="list-style-type: none"> <li>• Content developed in all sections</li> <li>• New structure and plan for finishing the technical section</li> <li>• Ethics and Education sections were restructured</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>• Restructure and finalize technical foundation section and engaging with experts to make final changes needed</li> <li>• Refinement of Business, Ethics, and Education sections to narrow in on mining-specific work</li> <li>• Creating a timeline for completion in 2021</li> </ul>
	<p><b>Open Data Sets for AI in Mining Guideline</b> Phase one: develop a guideline for making open data sets for AI in mining available. It covers management considerations such as benefits and business risks and license types and implementation considerations such as identifying data to be shared, extracting and preparing data, anonymization, risk assessment, approval and release, and making data sets public</p>	<p><b>Recent Developments:</b> A rough draft of the guideline will be ready shortly. A decision was made to demonstrate the efficacy of the guideline through the development of open data sets; 3 demo projects are in preliminary stages.</p> <p><b>Next Steps:</b> Carry out the demonstrations; update the guideline if needed. Following that, the guideline will undergo review prior to publication.</p>
Asset Management	<p><b>Proposed projects:</b></p> <ul style="list-style-type: none"> <li>• Develop a roadmap for journey from reactive maintenance to proactive asset management.</li> <li>• Develop a common taxonomy</li> </ul>	<p><b>Recent Developments:</b> The steering committee updated the group's mandate and agreed on the first two projects to be launched:</p> <ul style="list-style-type: none"> <li>• Development of a mobile mining asset management framework and roadmap</li> <li>• Development of common definitions</li> </ul> <p><b>Next Steps:</b> Virtual education events were held in December 2020 and January 2021. There will be two workshops in February to kick off the asset management framework project. The steering committee will be meeting in March.</p>

GROUPS	PROJECTS	LATEST INFO
Autonomous Mining	<p><b>Implementation of Autonomous Systems in Mining Guideline v2</b>  Guideline first published in 2019: Communicate and educate based on current industry practices and common terms of reference and provide guidance on justifying, planning, developing, testing, implementing, and executing autonomous systems. Version 2 is under development to update the content to reflect the rapidly changing landscape around autonomous technologies.</p>	<p><b>Recent Developments:</b>  The content generation phase was launched with the onboarding of volunteers.</p> <p><b>Next Steps:</b>  A series of workshops are planned for Q1 2021.</p>
	<p><b>System Safety White Paper</b>  Developing a white paper that aims to provide valuable context and education about system safety to enable safety and operational effectiveness throughout all phases of the autonomous system lifecycle.</p>	<p><b>Recent Developments:</b>  The steering committee met in November and revised the structure of the white paper. Each section was assigned champions to revise and peer review the content. In January 2021 the committee met once again to review and finalize each section. All sections have been completed except for one.</p> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>Gathering volunteers to finalize the section on software</li> <li>Send the full clean draft for critical review before final editing and layout</li> </ul>
	<p><b>Autonomous Mining Skills Migration Case Study Development</b>  Develop several case studies of skills migration and upskilling from organizations that have implemented autonomous systems that mining companies can use to help make their existing and new autonomous mining implementations successful.</p>	<p><b>Recent Developments:</b>  Four case studies (from Rio Tinto, Vale and two anonymous) are complete and will be published soon.</p> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>Publication of case studies on GMG website will be ongoing as they are received</li> <li>Seeking further companies to develop case studies</li> </ul>
GMG/MM-ISAC Cybersecurity	<p><b>Vendor Security Management Guideline</b>  Build a guideline for both operators and vendors to use to enable a resilient supply-chain. It will provide clear steps for vendors and operators to identify solutions to vulnerabilities in the vendor/operator system, understand how the industry is connected and provide guidance on asset management practices.</p>	<p><b>This guideline aims to provide:</b></p> <ul style="list-style-type: none"> <li>Context on the risks, industry challenges, and the importance of the risk assessment and scaling to risk</li> <li>General guidance on cybersecurity such as a list of key requirements and non-negotiables, roles and responsibilities, information sharing requirements, remote support and policy recommendations</li> <li>A technical framework including security monitoring approaches to a variety of vendor types and sizes, practices when sharing data, and how to securely transfer data</li> <li>Use cases that identify the onsite needs and categories of security risk associated with different types of vendors and understand how vendors and mining operations can establish an agreed approach to managing them. Suggested top use cases include authentication activities, account management, connection activities, and more.</li> <li>Guidance on validation and certification</li> </ul> <p><b>Next steps:</b>  Agree on a strategy for content development and collection of use cases</p> <p><b>Current needs:</b>  Involvement from cybersecurity and IT departments from industry (mining, OEMs, OTMs and consultants)</p>

GROUPS	PROJECTS	LATEST INFO
Data Access and Usage / Interoperability	<p><b>Mobile Equipment Technology Integration</b> Build a framework of how mobile equipment integrates with the ecosystem of other mining products and developing a common terminology.</p>	<p><b>Recent Developments:</b></p> <ul style="list-style-type: none"> <li>Leadership Council sub-committee identified this as an industry priority project to be launched in Q1</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>Form steering committee to define projects</li> <li>Series of workshops to enable volunteer input</li> </ul>
	<p><b>GMG Data Working Groups Definition Paper</b> The white paper will align the scope of the data access usage and interoperability working groups, and will define the focus and priorities for the newly named working group to address existing and new areas such as digital twins, and to ensure that we can provide horizontal support to the other working groups (e.g. Autonomous Mining)</p>	<p><b>Recent Developments:</b> Held two meetings in late November with member companies to discuss priorities and what currently exists and gather input. A suggestion was made to produce a white paper to position what the group will work on.</p> <p><b>Next Steps:</b> Formation of a small member committee to flush out content of the white paper. When drafted, it will be circulated to members for comment.</p>
	<p><b>Data Exchange for Mine Software (Open Mining Format)</b> The OMF is an open-source file specification to support data interchange across the entire mining community.</p> <p>Version 1, released in 2017, supports basic structures including points, lines, surfaces, meshes and volumes. Version 2 (under development) has extended that support to block models, computer-generated representations of orebodies that contain valuable data about them. Currently the C++ version is under development. Visit <a href="#">OMF on GitHub</a></p>	<p><b>Recent Developments:</b> Steerco group met in late November to identify a plan for the project. Outcomes:</p> <ul style="list-style-type: none"> <li>Need for communications tools for mining companies to help build support within organizations</li> <li>Finalize version 2 in the first half of 2021</li> <li>A mining companies sub-committee will set priorities for further development work</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>Confirm participation of mining companies to conduct on-site demonstrations of OMF (one mining company confirmed so far)</li> <li>Vendor sub-committee is meeting in Q1 towards finalizing version 2</li> <li>Development of communications tools for mining companies to help build support within organizations</li> </ul>
	<p><b>Mobile Equipment Open Data Consensus</b> In Fall 2020, a report was circulated among GMG mining company and OEM members to further refine and understand industry priorities. GMG has gathered responses from 6 OEMs and 8 mining companies, and an updated report based on these responses will be circulated shortly to define next steps. Based on the outreach, overall, the standard definitions challenge was identified as the top priority. This will likely branch into more than one project.</p>	<p><b>Recent Developments:</b> Report is in final stages before publication</p> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>Report to be reviewed by participating companies and GMG Leadership Council then published</li> <li>Report will be submitted to the Working Group Steering Committee for consideration in the development of the project pipeline</li> </ul>

GROUPS	PROJECTS	LATEST INFO
<p><b>Data Access and Usage / Interoperability</b> (cont'd)</p>	<p><b>Interoperability Definitions and Principles White Paper</b> A high-level white paper that that defines interoperability and describes high-level principles.</p>	<p><b>Recent Developments:</b> Finalization group met in early December and decided to publish this as a white paper (originally planned as a guideline), which better reflects its purpose. Roadmap, previously part of it, will be taken out and shared with the Mobile Equipment Technology Integration Leadership Council sub-committee as a reference</p> <p><b>Next Steps:</b> Reformatting and final sign-off for publication</p>
	<p><b>Interoperability Landscape</b> Produce a live, searchable database of interoperability initiatives to help the industry identify what is out there and enable a feedback mechanism for identifying priorities and connections.</p>	<p><b>Next Step:</b> Release first iteration</p>
<p><b>Underground Mining</b></p>	<p><b>Location Tracking</b> Develop a guideline for mining companies looking to implement location tracking within their mines that covers key use cases and explains the technical aspects of location tracking technologies in a GPS-denied environment.</p>	<p><b>Recent Developments:</b> A meeting was held in October to determine the best way to share information on location tracking. It was decided that a use cases approach would be the most effective and volunteers would submit them with a template created by GMG. A “solutions” section of the guideline would also support the materials collected. The goal being that the user would use the guideline as a starting off point for their project to help develop their idea and create a project plan based on others best practices.</p> <p><b>Next Steps:</b> Meet in Q1 2021 to review submitted use cases as well as look over “solutions” section of the document.</p>
<p><b>The Electric Mine</b></p>	<p><b>Battery Electric Vehicles in Mining Guideline v3</b> Battery Electric Vehicles in Mining v3 project aims to update the previous version of the guideline leveraging lessons learned, particularly related to safety and maintenance, and accommodating technology advancements. A separate white paper focused on electric equipment for surface mining is under consideration.</p>	<p><b>Recent Developments:</b> Content developed over the last four months by volunteer experts includes:</p> <ul style="list-style-type: none"> <li>• New risk assessment section</li> <li>• A proposed re-structure for the chargers section by charger experts</li> <li>• Ventilation section was expanded</li> <li>• Vehicle design section was re-structured</li> <li>• New content on HVDC electrical systems</li> <li>• Preliminary edit complete to clean up the document</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>• Surface mining operators meeting to determine plan</li> <li>• Battery experts to review existing content</li> <li>• Mining companies to conduct critical review of content</li> <li>• A series of peer review workshops with project group to review entire draft guideline and fill in minor gaps</li> </ul>

GROUPS	PROJECTS	LATEST INFO
<p>The Electric Mine (cont'd)</p>	<p><b>Electric Mine Operational Knowledge Sharing Platform</b> Create a neutral platform to share operational data for electric surface and underground equipment. The industry can use this information to accelerate innovation and adoption.</p>	<p><b>Recent Developments:</b></p> <ul style="list-style-type: none"> <li>• Drafted KPIs</li> <li>• Researched options for a platform development and hosting</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>• Develop KPIs as a guideline</li> <li>• Mining companies prioritizing what data they will share and how it will be collected</li> <li>• Circulate an RFP for the platform</li> </ul>
	<p><b>Industrial Comminution Efficiency – Guideline Review</b></p> <ul style="list-style-type: none"> <li>• <i>Determining the Bond Efficiency of Industrial Grinding Circuits</i> (Published in 2016, Under Review)</li> <li>• <i>Morrell Method for Determining Comminution Circuit Specific Energy and Assessing Energy Utilization Efficiency of Existing Circuits</i> (Published in 2016, Under Review)</li> <li>• <i>Methods to Survey and Sample Grinding Circuits for Determining Energy Efficiency</i> (Published in 2016, Review scheduled for 2021)</li> </ul>	<p><b>Recent Developments:</b> Bond and Morrell guideline review meetings were held, both guidelines have minor changes needed, and content updates and editing are underway</p> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>• Final Bond Efficiency draft guideline is very close to completion (finalization of the layout) and will be sent for approval by the project leaders</li> <li>• Final Morell Method draft guideline will soon be completed and a meeting will be held for peer review</li> <li>• Initial meeting to review the Survey and Sample Grinding Circuits guideline will happen in early 2021</li> </ul>
	<p><b>Working Group has many proposed potential projects under development. All are with ad hoc steering committees to flush out problem statements, objectives and scopes, to be submitted to the Working Group steering committee for approval.</b></p>	
<p>Mineral Processing</p>	<p><b>Overall Equipment Effectiveness (OEE)</b> Proposed guideline on what measures should be for different unit operations and how to select the appropriate availability, performance, and quality components</p> <p><b>Geometallurgy (GeoMet)</b> Develop guidance on industry best practices in geometallurgy, targeted at young professionals entering the industry, mining company decision-makers and the general mine workforce</p> <p><b>Process Control</b> Developing guidance to address issues such as a lack of standardized operating procedures, very few KPIs, differences between how different operators run the plant, etc. and a general lack of understanding throughout industry about geometallurgy and its role</p> <p><b>Metal Accounting</b> Proposed guideline on operations (performance/inventory monitoring and troubleshooting). Design (best practices in accounting system design), and governance (implementing the metal accounting code)</p>	<p><b>Fine Grinding Ore Characterization Basis</b> Develop an open-source laboratory test and specific energy basis that mine owners and design engineers can use to both generate first-pass “generic stirred mill” equipment sizes</p> <p><b>Standard Bond Ball Charge and Bond Test Reference Materials</b> Carried out concurrently, they will provide a source of the standard Bond Ball Mill Test ball charge to the industry and generate reference materials that can be used to check individual lab results compared to a standard</p> <p><b>Grinding Circuit Efficiency</b> Developing a guideline to capture best practices in grinding circuit efficiency</p> <p><b>Starkey SAGDesign Guideline for Comminution Testing and Grinding Mill Design</b> Outline the Starkey SAGDesign test and design methodology and make it widely available for public use</p>



## EXECUTIVE COUNCIL

Chair	Incoming Chair	Outgoing Chair	Vice-Chair Working Groups	Treasurer	Secretary
Michelle Ash CEO, Geovia Division Dassault Systèmes	Kalev Ruberg VP Future and CIO Teck	Heliuss Guimaraes Digital Transformation Leader Alcoa	Andrew Scott Principal Innovator Symbiotic Innovations	Kelly McLean Data Scientist PETRA Data Science	Mark Richards Manager Mining Technology, Technical Services Group Teck

## GOVERNING COUNCIL

### Executive Council members



### Regional Representatives

<b>Latin America</b> Ricardo Aguilera, Director Customer Engagement, RPM Global	<b>Latin America</b> Laura Mottola, President & CEO, Flow Partners	<b>Brazil</b> Patricia Procopio, Founder, MP Consulting	<b>South Africa</b> Jean-Jacques Verhaeghe, Programme Manager: Real-Time Information Management Systems (RTIMS), ICT, and Digitalisation, JVA
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### Working Group Leaders

<b>Artificial Intelligence</b> Mark O'Brien, CIO and General Manager - Digital Technology & Innovation, CITIC Pacific Mining	<b>Artificial Intelligence</b> Mohammad Babaei, Senior Technical Analyst, Digital Operations, Teck	<b>Asset Management</b> Zoli Lukacs, Advisor, Asset Optimization	<b>Autonomous Mining</b> Graeme Mitchell, Director Autonomous Systems, Aurecon	<b>Cybersecurity</b> Rob Labbe, Director, Information Security, Teck
<b>Electric Mine</b> Kevin Lueschow, Product Safety Consultant, Caterpillar	<b>Interoperability / Data</b> Alvaro Roza, VP of Operational Applications, ShookIOT	<b>Mineral Processing</b> Aidan Giblett, Senior Technical Advisor, Newmont	<b>Underground Mining</b> Riaan van Wyk, Director of New Products Development and Innovation, Davey Bickford Enaex	<b>Underground Mining</b> Russell Kennett, Principal Engineer - Underground Technology & Systems, Rio Tinto

## LEADERSHIP COUNCIL

Chair	Incoming Chair	Outgoing Chair	Vice-Chair Working Groups	Accenture
Michelle Ash CEO, Geovia Division Dassault Systèmes	Kalev Ruberg VP Future and CIO Teck	Helius Guimaraes Digital Transformation Leader Alcoa	Andrew Scott Principal Innovator Symbiotic Innovations	Amy Callahan, Managing Director Liv Carroll, Senior Principal, Analytics, Digital Mining George Long, Senior Manager Resources, Digital Transformation
Anglo American	Aurecon	BHP	Caterpillar	Dassault Systèmes
Carlos Erazo, Principal Mine Modernisation	Graeme Mitchell, Director Autonomous Systems Brent Slattery, Capital Performance Leader	Chirag Sathe, Principal Risk & Business Analysis Technology	Carl Hendricks, Mining Automation & Solutions Regional Manager Michael Murphy, Chief Engineer	Jeff Hamilton, Director - Brand Strategies & Alliances
Epiroc	Glencore	Hatch	Inmarsat	Komatsu
Don King, VP - Global Strategic Customers Anders Hedqvist, VP Research & Development Mikael Ramstrom, VP Product Portfolio Automation & Interoperability	Tony Egan, Coal Assets Australia Dominic Fragomeni, VP, Strategic Innovations Owain Morton, Business Transformation Mining Lead	Vic Fitzmaurice, Mining Lead Australia Denis Gratton, Mining Executive, Strategic Planning, Operations, Technical Services, Project Development and Execution Farah Kaboodanian, Control & Automation Global Discipline Director	Nick Prevost, Director of Mining Innovation	Brian Fox, VP - Product Management Michael Lewis, VP - Product Innovation
METS Ignited	Motorola	Orica	Stantec	Teck
Adrian Beer, CEO Ian Dover, General Manager	Lisa Boutilier, Corporate Account Manager - Mining, North America Scott Schoepel, VP Commercial Markets	Santiago Burgada, Head of Marketing Richard O'Meara, NA Technical Services Director	Kate McLaughlin, Discipline Leader, Mining Jon Treen, Senior VP	Mark Richards, Manager Mining Technology
Vale	Vedanta			
Luke Mahony, Global Head of Geology, Mine Engineering, Geotechnical and Technology & Innovation	Praveen Singh, Digital Officer Vinod Wagh, Leading Technology Initiatives			

## INDUSTRY FOCUS = GMG FOCUS

GMG is an industry-led open platform – global priorities are industry’s priorities which are our priorities. Our members identify areas of focus and together we set out to develop knowledge, educate and provide guidance to the global mining industry.

In response to the COVID-19 pandemic, we are focusing on enabling our members to collaborate on projects and share best practices of how they are currently working towards ensuring their sustainability while not compromising the health and safety of their workers.

The opportunities for cross-learning are endless.



GLOBAL MINING GUIDELINES GROUP

**GMG**



Innovation through Collaboration

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